

REMARKS

Claims 17-20 currently appear in this application. The Office Action of October 4, 2005, has been carefully studied. These claims define novel and unobvious subject matter under Sections 102 and 103 of 35 U.S.C., and therefore should be allowed. Applicants respectfully request favorable reconsideration, entry of the present amendment, and formal allowance of the claims.

Claims 1-8 and 13-16 are rejected under 35 U.S.C. 102(b) as being anticipated by Bodnar et al., U.S. Patent No. 5,143,945.

Claims 1-8 and 13-16 have been cancelled by the present amendment, so this rejection is now moot.

Claims 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bodnar et al. as applied to claims 1-8 and 13-16 above and further in view of Tsai, U.S. Patent No. 4,673,696.

This rejection is respectfully traversed. Claims 9-12 have now been rewritten as new claims 17-20. Bodnar et al. teach that carbon dioxide gas generated by a reaction between a carboxylic acid and an isocyanate group is used as a foaming agent in order to reduce the amount of a flow to be used. Water is optional as a blowing agent.

In contrast thereto, the present invention improves the brittleness and adhesive properties of a face material in a rigid polyurethane foam which is produced by using water, or a combination of water and a flon, as a blowing agent.

Tsai adds nothing to Bodnar et al., because Tsai does not disclose producing polyurethane foams. All that Tsai discloses is that a maleic acid ester can be used to make a

storage stable blend of a long chain polyol and a short chain diol in which the diol is present in an amount whereby the diol and polyol form an incompatible blend. The concept of making a compatible blend of a long chain polyol and a short chain diol has nothing to do with producing a polyurethane foam using water as a blowing agent, so there is no motivation to combine the maleic acid ester of Tsai with the method of making a polyurethane foam of Bodnar et al.

In the method of the present invention, when water is a foaming agent, an amine is generated by the reaction between water and an isocyanate group. A urea group is generated further through a reaction between the amine and the isocyanate group. The urea group has high cohesive force, and thus is has the disadvantage of making the polyurethane foam brittle, particularly the surface layer of the polyurethane foam. When the surface layer is brittle, the adhesive properties between a structural material and the surface layer of the polyurethane is remarkably impaired.

The object of the present invention is to improve the flexibility (*i.e.*, reduce the brittleness) in a rigid polyurethane foam by using the reaction between an unsaturated bond of a maleic acid ester and a primary amino group of the amine, even when water is used as the foaming agent. In the present invention, the primary amino group of the amine smoothly reacts with the unsaturated bond of the maleic acid ester.

That is, the mechanism for decreasing the brittleness is reacting a maleic acid ester with a primary amine produced by the reaction between water and the isocyanate group so as to produce a secondary amino group, followed by the reaction of the secondary amino group with another isocyanate group. In the conventional case of foaming

with water, a urea group is produced. However, when using a maleic acid ester as a modifying agent, one of the hydrogen atoms of the urea group is substituted with a molecule of the maleic acid ester. This substituted urea bond prevents the excessive agglomeration of the urea bond. This decreases the brittleness of the urethane foam, so that the adhesive properties of the face of the polyurethane foam are improved.


Bodnar et al. use carbon dioxide gas generated by the reaction between the carboxylic groups and the isocyanate group as the foaming agent. Therefore, there is no motivation to use a maleic acid ester as in Tsai as a compatibilizing agent, as Tsai does not disclose using carbon dioxide gas, or any other component, as a foaming agent. In fact, Tsai does not even disclose foaming agents, but merely discloses that a maleic acid ester can be used to produce a storage stable blend of a long chain polyol and a short chain diol.

It is noted that the prior art made of record and not relied upon is considered to be merely pertinent to applicant's disclosure.

In view of the above, it is respectfully submitted that the claims are now in condition for allowance, and favorable action thereon is earnestly solicited.

Respectfully submitted,

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